State of California

Memorandum

To : Bob Reid

Date : March 12, 1981

Subject: Application for Class II Primacy

From : **Department of Conservation—Division of Oil and Gas**

Place: Long Beach

A. Case of Possible Degradation

Richfield Oilfield

Texaco, Inc. injector YW-9 was acidized on 11/7/80 and on 11/8/80 Union Oil Co. "Yorba Linda Group" 4 (abandoned in 1975) began flowing about 600 b/d water from around the casing. The injector (and others) was shut in and the flow decreased and later stopped.

Subsequent investigations suggested a top perforation leak in the injector at 2786', with communication between the two wells through an aquifer at about 2675'. A shale interval at 2680'± was later squeezed to solve the problem. The base of fresh water is about 1000'.

A poorly placed BFW plug in the Union well resulted in migration of the injection water up the casing annulus from about 2675' to the surface.

B. Nonhydrocarbon Injection Zones

1. Gaspur Aquifer -- Wilmington FB II, III, IV, V.
   See attached plates from LACFCD Dominguez Gap Barrier Project, March 1962.

2. Puente Formation -- Sawtelle Oil Field
   The Injection interval is 988' of sands in the Puente Formation of late Miocene age. Depth to the uppermost sand is 3120'. Available reservoir volume was calculated at 691 acre-ft. This is a highly faulted area and limits are unknown.

3. Alpha I & II Aquifers -- Huntington Beach Oil Field
   These aquifers average 100' (gross) in thickness and are in the upper portion of the Lakewood Formation of late Pleistocene age. These zones in the area of injection are confined to the NE by the Newport-Inglewood fault and Santa Ana River channel fill. These zones also appear to outcrop underneath the ocean to the SW. Depths to the Alpha I aquifer near the fault are 70-100'.

4. "Recent" sands -- Seal Beach Oil Field
These sands cover a rather extensive area along the coast and inland to the Central Basin. Seaward, the sands are either thinly covered or outcrop in the sea floor. Depths average about 40 to 60 feet and thicknesses range from 10 to 40 feet.

5. "Repetto" sands -- Seal Beach Oil Field
Disposal is into 620' of "Repetto" sands of early Pliocene age. Depth to the uppermost sand is 3860'. The only known lateral limit is the Seal Beach fault to the NE.

6. BP, R, S, T, F_o, F sands -- Belmont Offshore Oil Field
These sands are part of the Repetto formation of lower Pliocene age. The top of the R sand is between 2670' and 2850' deep. The thickness of the injection interval varies between 340' to 640'.

Sincerely,

Richard W. Strehle

Richard W. Strehle
Enhanced Recovery Engineer

RWS:eb

Attachments

State of California

THE RESOURCES AGENCY OF CALIFORNIA

Memorandum

To : ALL DEPUTIES
ALL SENIOR ENGINEERS

Date : February 18, 1981

Subject : Application for Class II Primacy

From : Department of Conservation — Division of Oil and Gas
Sacramento

The attached notice will be published twice in each of the following newspapers, between March 12 and March 15, 1981.

Los Angeles Daily Journal
Long Beach Press Telegram
Santa Barbara News Press
Bakersfield Californian
Sacramento Bee
Fresno Bee

Members of the public should be given access to "California Oil and Gas Fields", Volumes I and II, when requesting information on hydrocarbon-producing zones. We plan to request an exemption from the Safe Drinking Water Act for all hydrocarbon-producing zones listed in these volumes.

In addition, access should be provided to the information requested under Item 3 of my February 11, 1981 memo. However, I wish to emphasize that the project files must remain confidential.

Contact Jim Campion if you have any questions regarding these instructions.

Si Cordova

Simon Cordova
Chief Deputy

cc: J. Campion
R. Reid

...IFORNIA—RESOURCES AGENCY
...T OF CONSERVATION
...ION OF OIL AND GAS
...9th STREET, ROOM ~~1416~~ 1310
...RAMENTO, CALIFORNIA 95814
...) 445-9686

NOTICE OF THE CALIFORNIA

DIVISION OF OIL AND GAS

The California Division of Oil and Gas is preparing an application for submittal to the Environmental Protection Agency requesting the exemption of certain aquifers from provisions of the Safe Drinking Water Act. The exemption will be requested because the aquifers are either hydrocarbon-bearing or are currently being used for the underground injection of oil- or gas-field waste water.

Interested parties may obtain information on the specific aquifers for which the division will request exemption at the division district offices listed below.

District No. 1: 5199 E. Pacific Coast Hwy., Suite 309–N, Long Beach 90804
Phone: (213) 590–5311

District No. 2: 146 S. Ojai Street, P.O. Box 67, Santa Paula 93060
Phone: (805) 525–2105

District No. 3: 301 W. Church Street, P.O. Box 227, Santa Maria 93454
Phone: (805) 925–2686

District No. 4: 4800 Stockdale Hwy., Suite 417, Bakersfield 93309
Phone: (805) 322–4031

District No. 5: 466 N. Fifth Street, P.O. Box 616, Coalinga 93210
Phone: (209) 935–2941

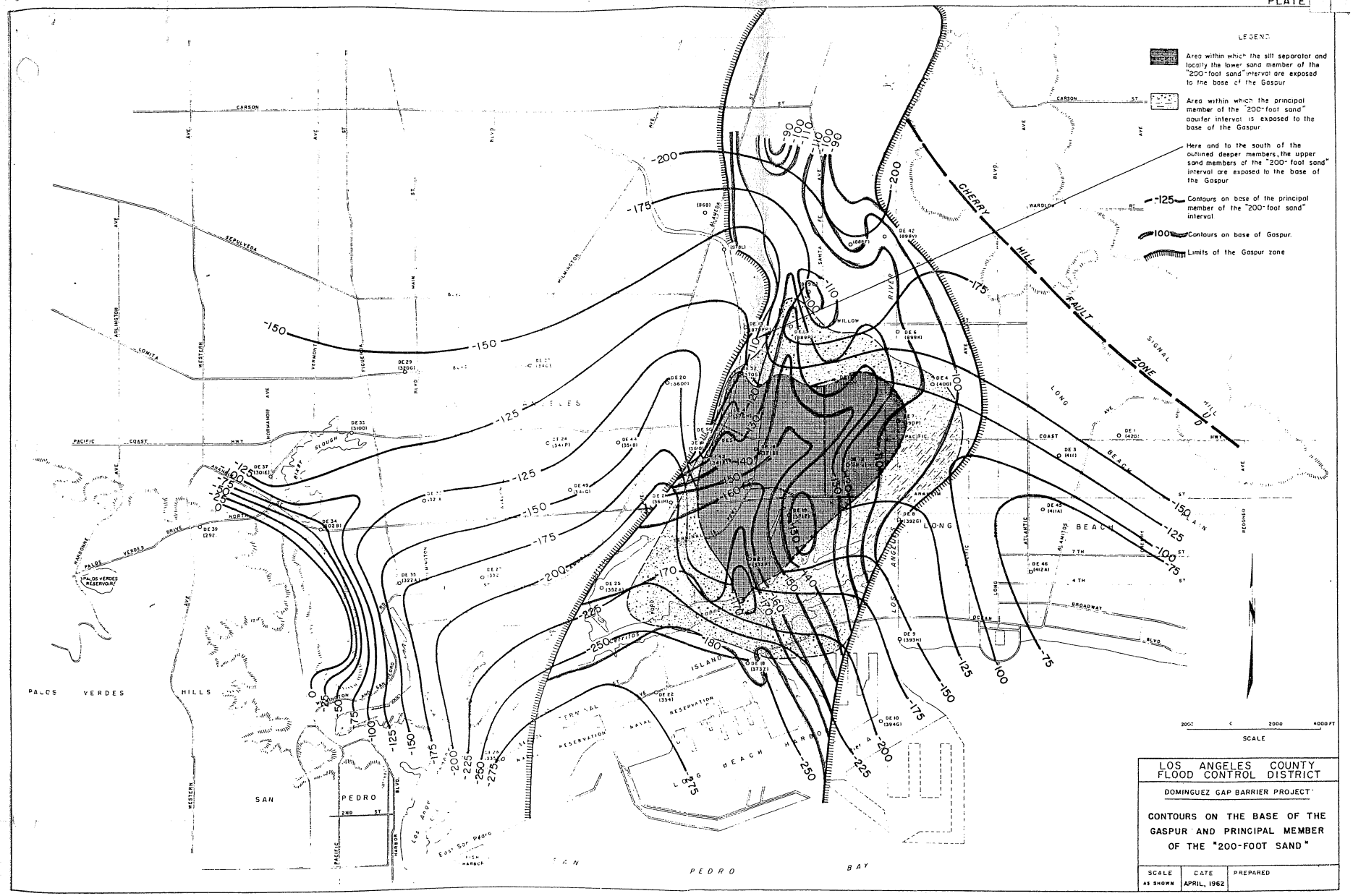
District No. 6: 117 W. Main Street, Suite 11, Woodland 95695
Phone: (916) 662–4683

Persons wishing to comment on the listed aquifers must direct their comments to the State Oil and Gas Supervisor, 1416 Ninth Street, Room 1310, Sacramento, CA 95814, no later than April 1, 1981.

M. G. Mefferd
State Oil and Gas Supervisor

February 18, 1981

PLATE



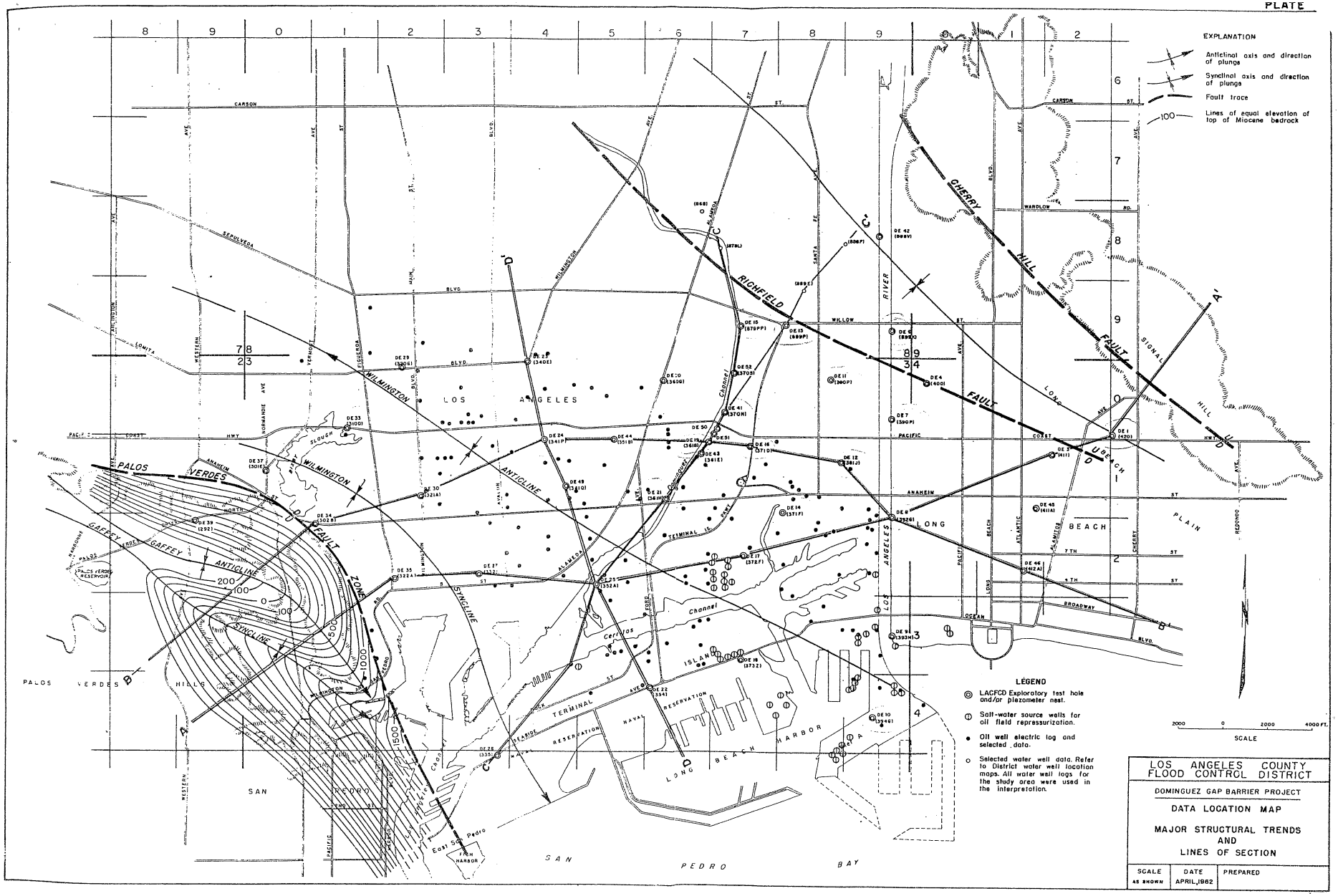
LOS ANGELES COUNTY FLOOD CONTROL DISTRICT

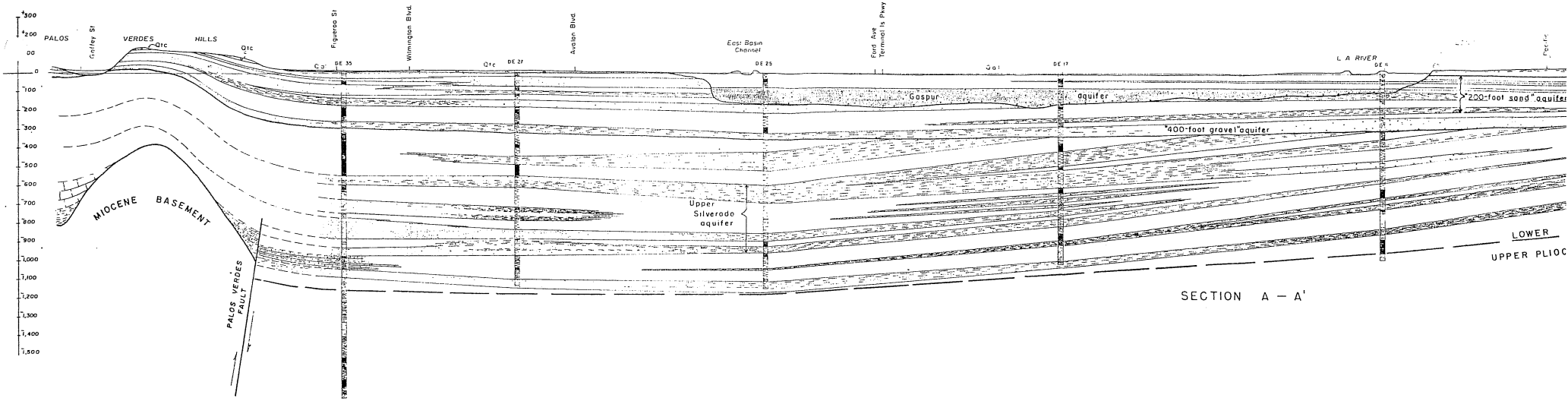
DOMINGUEZ GAP BARRIER PROJECT

CONTOURS ON THE BASE OF THE GASPUR AND PRINCIPAL MEMBER OF THE "200-FOOT SAND"

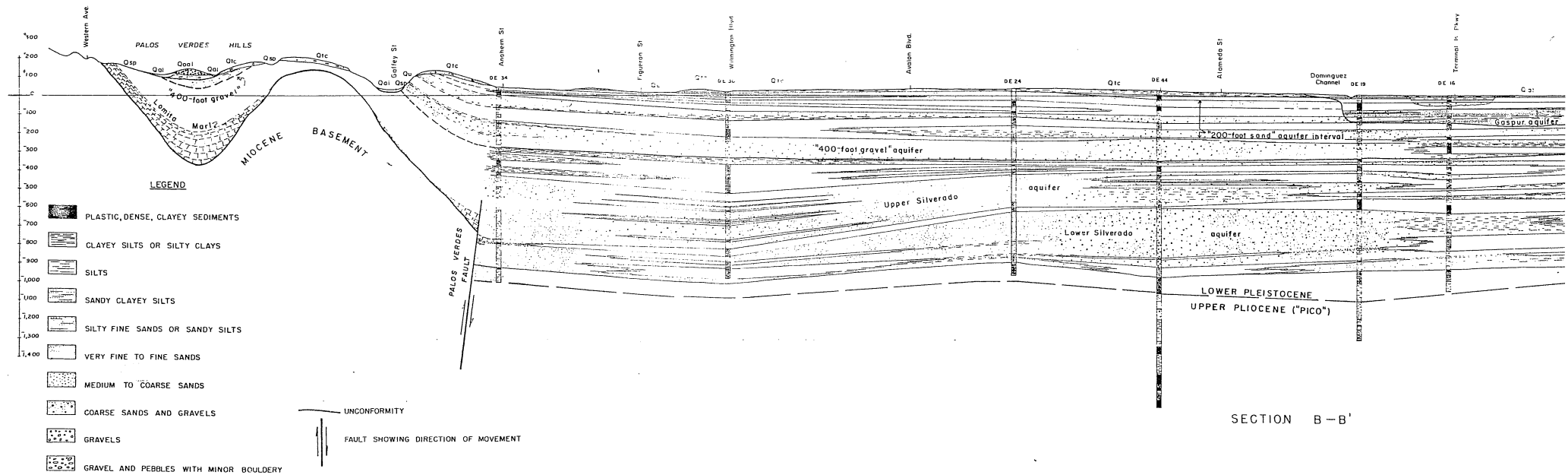
SCALE	DATE	PREPARED
AS SHOWN	APRIL, 1962	

PLATE


EXPLANATION
Anticlinal axis and direction of plunge
Synclinal axis and direction of plunge
Fault trace
100 Lines of equal elevation of top of Miocene bedrock
LEGEND
LACFCD Exploratory test hole and/or piezometer nest.
Salt-water source wells for oil field repressurization.
Oil well electric log and selected data.
Selected water well data. Refer to District water well location maps. All water well logs for the study area were used in the interpretation.
SCALE
2000 0 2000 4000 FT.
LOS ANGELES COUNTY FLOOD CONTROL DISTRICT
DOMINGUEZ GAP BARRIER PROJECT
DATA LOCATION MAP
MAJOR STRUCTURAL TRENDS AND LINES OF SECTION
SCALE AS SHOWN
DATE APRIL, 1962
PREPARED
PALOS VERDES HILLS
LOS ANGELES
LONG BEACH
SAN PEDRO BAY
WILMINGTON
ANTICLINE
PALOS VERDES FAULT ZONE
GAFFEY ANTICLINE
SYNCLINE
RICHFIELD FAULT
CHERRY HILL FAULT
LONG BEACH FAULT
A
A'
B
B'
C
C'
D
D'



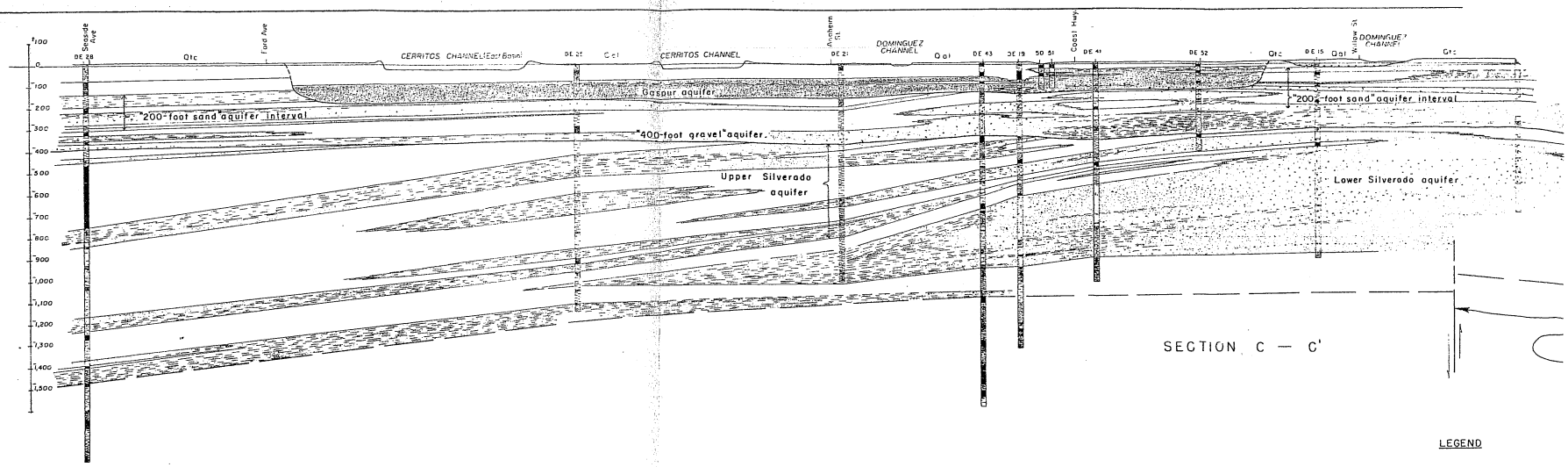
SECTION A — A'



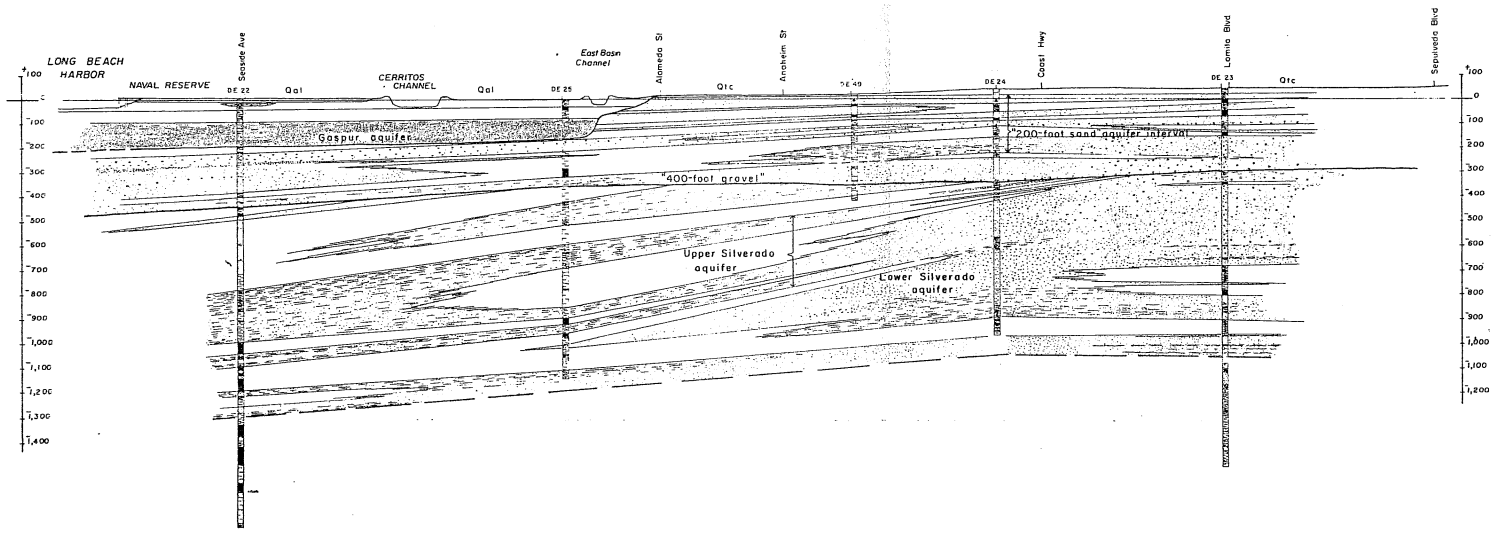
SECTION B—B'

LEGEND

- PLASTIC, DENSE, CLAYEY SEDIMENTS
- CLAYEY SILTS OR SILTY CLAYS
- SILTS
- SANDY CLAYEY SILTS
- SILTY FINE SANDS OR SANDY SILTS
- VERY FINE TO FINE SANDS
- MEDIUM TO COARSE SANDS
- COARSE SANDS AND GRAVELS
- GRAVELS
- GRAVEL AND PEBBLES WITH MINOR BOULDERY MATERIAL
- UNCONFORMITY
- FAULT SHOWING DIRECTION OF MOVEMENT



SECTION C — C'



SECTION D — D'

LEGEND

- PLASTIC, DENSE, CLAYEY SEDIMENTS
- CLAYEY SILTS OR SILTY CLAYS
- SILTS
- SANDY CLAYEY SILTS
- SILTY FINE SANDS OR SANDY SILTS
- VERY FINE TO FINE SANDS
- MEDIUM TO COARSE SANDS
- COARSE SANDS AND GRAVELS
- GRAVELS
- GRAVEL AND PEBBLES WITH MINOR BO MATERIAL
- UNCONFORMITY
- FAULT SHOWING DIRECTION OF MOVEME

State of California

Memorandum

To: Jim C ✓ we have (2) made copies
Bob J ✓

To : Simon Cordova, Sacramento

Date : March 16, 1981

Subject : APPLICATION FOR CLASS II PRIMACY

From : Department of Conservation—
Division of Oil and Gas

Place: Santa Paula

RECEIVED
MAR 18 1981
DIVISION OF OIL & GAS
SACRAMENTO

The accompanying report contains the data you requested in your letter dated February 11, 1981.

The information under 3b, no survey for water disposal wells applies to 1980 only.

John L. Hardoin
Deputy Supervisor
MD:b

FORM K

DISTRICT 2 - 1980

	FIELD	OPERATOR	WELL	TYPE OF DEFICIENCY
1a.	Placerita	Murray-Teague Assoc.	"Thompson" 1	Injection survey - no test
	Ventura	Getty Oil Company	"V.L.& W." 78	" " " "
1b.	None			
1c.	None			
2a.	None			

	DISTRICT	FIELD	OPERATOR AND WELL DESIGNATION	YEAR DISCOVERED	CAUSE
2b.	2	Aliso Canyon	Getty Oil Co. "Porter" 33	1980	No Inj.survey
	"	" "	" " " "Fernando Fee" 30	"	" " "
	"	" "	" " " "Mission Adrian Fee" 1	"	" " "
	"	Del Valle	Union Oil Co. of Calif."Oak Park" 12	"	" " "
	"	Eureka Canyon	Petro Lewis Corp. "Sloan" 1	"	" " "
	"	Honor Rancho	Texaco Inc. "Honor Rancho" A(NCT-2) 5	"	" " "
	"	" "	" " "Honor Rancho" A(NCT-2) 35	"	" " "
	"	Newhall	Morton & Dolley "Needham" 15	"	" " "
	"	Oak Canyon	Hathaway Bros. "Ram" 3	"	" " "
	"	Oat Mountain	Union Oil Co. of Calif. "Del Aliso" 1-2	"	" " "
	"	Ojai	Sun Oil Co. "Hamp" 45	"	" " "

DISTRICT	FIELD	OPERATOR AND WELL DESIGNATION	YEAR DISCOVERED	CAUSE
2	Ojai	Ojai Oil Co. 6	1980	No Inj. survey
"	Oxnard	Chase Production Co. "Todd" 1	"	" " "
"	Piru	Getty Oil Co. "Crocker Fee" 10	"	" " "
"	Placerita	Grace Petroleum Corp. "Strebel" 1	"	" " "
"	"	" " " "Yant" 4	"	" " "
"	"	Crown Central Pet. "WF" 35	"	" " "
"	"	" " " "KPM" 17	1979	Hole in casing
"	"	Petro Resources Inc.,Opr. "Sir Kegian 3WD	1980	No Inj. survey
"	"	Grace Petroleum Corp. "PRI FEE" WD-1	"	" " "
"	Ramona	Chevron U.S.A.Inc. "Aquirre" 101	"	" " "
"	"	Texaco Inc. "Kern" 35	"	" " "
"	Sespe	Damson Oil Corp. 3	"	" " "
"	Simi	Union Oil Co. of Calif. "Canada de la Brea" 6	"	" " "
"	Ventura	Mobil Oil Corp. "Barnard" 29W	"	" " "

2c. No cases

3. See accompanying chart.

State Division of Oil and Gas - District 2
NONHYDROCARBON PRODUCING-ZONES BEING USED FOR WASTE WATER DISPOSAL

Field	Formation & Zone	Lateral Limits	Depth to Top (feet subsea)	Thickness (feet)	Remarks
Ramona	Pico marine strata (Pliocene) basal sand	Extends throughout field	+153'	200'	Sand thickens to West
So.Tapo Canyon	Pico marine strata (Pliocene)	SW part of field	+829'	70'	
Oat Mountain	Undiff. marine strata (Miocene)	Sec. 19 & SW 1/4 Sec. 20 T.3N,R.17W	+1143'	2200'	
Simi	Sespe nonmarine strata (Oligocene)	Area N. of C.D.L.B. Fault, Alamos Area	+347'	400'	Part of injection interval may be in 1st oil zone

3/13/81

To: Jim C ✗ we have (3)
Bob J ✗ made copies

State of California

Memorandum

To : Bob Reid

Ec

Date : March 16, 1981

Subject : Application for Class II Primacy

From : **Department of Conservation—**
Division of Oil and Gas

Place: Santa Maria

RECEIVED
MAR 18 1981
DIVISION OF OIL & GAS
SACRAMENTO

Enclosed is the material requested in your letters of February 11, and March 10, 1981.

Please note that no systematic records are available for the early years. If there were problems, the documentation would be buried in the files. There may have been reference to them in the monthly news letters to headquarters, which were destroyed under the paperwork management program.

John L. Zulberti
Deputy Supervisor

JLZ:mjn
Encl.

FORM K

SUPPORTING DATA FOR EPS UIC PROGRAM CLASS II PRIMACY APPLICATION

1. Compliance and well-failure information for 1980.

   a. Deficiencies:

Operator	Well designation and No.	Type
Sun Oil Company	"Dominion" 45-23	Pressure limitation
Union Oil Co. of Calif.	"Bell" 20	Fluid confinement
Texaco Inc.	"Cantin" WD-3	Pressure limitation
Chevron U.S.A. Inc.	"Alexander" 58-16	Interference
Chevron U.S.A. Inc.	"Alexander" 62	Interference
Mobil Oil Corporation	"White" 32W-21	Interference
Mobil Oil Corporation	Six wells in Sec.35	Pressure limitation

   b. Violations:

Richards Oil Company	"Wickenden" 6	Supporting data
Mobil Oil Corporation	"Ferrini" 503-11	Well survey
Mobil Oil Corporation	"Rosenberg" 828X-35	Well survey
Union Oil Co. of Calif.	"Pinal" 21	Well survey
Union Oil Co. of Calif.	"Pinal" 27	Well survey
Union Oil Co. of Calif.	"Squires" 24	Well survey
SM Hydrocarbons	"Los Flores" 9	Well survey

   c. Number of mechanical-integrity failures:

   None

2. Cases of possible degradation of freshwater since 1940.

   a. Verification of listed wells:

Field	Operator & Well designation	Year Discovered	Cause
*Casmalia	Chevron U.S.A. Inc. "Casmalia Fee" 8	1974	Excessive injection pressure
Cat Canyon East Area	Occidental Petroleum Corp. "Williams B" 2	1973	Poor cement seal No injection
SM Valley	Argo Petroleum Corp. "Union Sugar" 1	1973	Never approved Possible interference

   *No fresh water in this area.

   b. Cases not listed:

Field	Operator & Well designation	Year Discovered	Cause
San Ardo North Area	Mobil Oil Corp. "Rosenberg" 802X-35, 801-35, 872X-35, 872X-35, 828X-35 & 803X-35	1979	Excessive injection pressure
Cat Canyon West Area	Mobil Oil Corp. "Los Flores A" 3-21	1977	Casing failure
San Ardo North Area	Mobil Oil Corp. "Rosenberg" 803X-35	1977	Casing failure

   c. Time lapse between discovery and correction if over one year for each case in 2a and 2b.

   None

3. NON-HYDROCARBON PRODUCING ZONES BEING USED FOR WASTE WATER DISPOSAL

Field	a. Formation & Zone	b. Lateral Limits	Depth to Top (feet subsea)	c. Thickness (feet)	Remarks
Guadalupe	Knoxville	Extends throughout the field	-4,100	750	This formation is basement and is of regional extent.
Lompoc	Lospe	Extends throughout the field	-2,700	150	This formation is just above basement; might be of regional extent.
	Knoxville	Extends throughout the field	-1,500	250	This formation is basement and is of regional extent.
Russell Ranch	Branch Canyon	Extends over the southern 2/3 of the field	+ 100	400	
San Ardo	Santa Margarita	Extends throughout the field	- 900	100	There appears to be a permeability barrier between north and south portions of field.
	"D" (Monterey)	Extends throughout the field	-1,200	30	
	"E" (Monterey)	Extends throughout the field	-1,300	100	
Santa Maria Valley	Lospe-Franciscan	T.10N., R.33W., S.B.BM Secs. 19, 20, 21, 28, 29, 30, 32 & 33	-1,800	800	These formations are basement and are of regional extent.
Monroe Swell	Santa Margarita	Extends throughout the field	- 800	150	
Point Conception	Camino Cielo	Extends throughout the field	-4,500	450	Formerly Matilija
Guadalupe	Franciscan	Extends throughout the field	-5,700	1,000	This formation is basement and is of regional extent.

State of California

(4)

FORM K

Memorandum

To : Si Cordova
Sacramento

Date : March 11, 1981

Subject: Application for Class II Primacy

From : **Department of Conservation—Division of Oil and Gas**

Place: Bakersfield

In regard to your request for data concerning underground injection, attached is information from District 4 to be used in preparing the division's application for primacy over Class II projects.

David Mitchell

Dave Mitchell
Associate Oil & Gas Engineer

GWH/DM/mm

1. (a)-1980 Deficiencies

1) West Bellevue Western Continental Operating Co. "Wesco-Clark" 13-33 33 29S/26E
1/80: Holes in tubing and casing. Injection ceased until tubing replaced and packer installed 6/80. 10/80: Hole in tubing again, tubing replaced. 12/80: Survey indicates problem solved.

2) North Coles Levee ARCO Oil & Gas Co. "Coles Levee A" 41-32 32 30S/25E
10/80: Developed hole in tubing. Well shut-in until tubing repaired or replaced.

3) North Coles Levee ARCO Oil & Gas Co. "Coles Levee A" 43-32 32 30S/25E
3/80: Flow in annulus due to packer leak. Packer replaced.

4) North Coles Levee ARCO Oil & Gas Co. "Coles Levee A" 45-32 32 30S/25E
3/80: Flow in annulus due to packer leak. Packer replaced.

5) North Coles Levee ARCO Oil & Gas Co. "Coles Levee A" 46-32 32 30S/25E
3/80: Flow in annulus due to packer leak. Packer replaced.

6) North Coles Levee ARCO Oil & Gas Co. "Coles Levee A" 66-28 28 30S/25E
3/80: Flow in annulus due to packer leak. Packer replaced.

7) North Coles Levee ARCO Oil & Gas Co. "Coles Levee A" 84-30 30 30S/25E
3/80: Flow in annulus due to packer leak. Packer replaced.

8) North Coles Levee ARCO Oil & Gas Co. "Coles Levee A" 88-30 30 30S/25E
3/80: Flow in annulus due to packer leak. Packer replaced.

9) South Coles Levee Marathon Oil Co., Opr. "SCLU" 27-11 11 31S/25E
7/80: Flow in annulus due to packer leak. Packer replaced.

10) Fruitvale Mohawk Petroleum Inc. "Red Ribbon" 8 27 29S/27E
3/80: Casing split, migration to surf. Well squeezed with cement 6/80, split repaired, inj. resumed.

11) Kern River Tenneco Oil Co. "Comet" WDW 1 28 28S/28E
5/80: Injection line leaking. Repaired.

12) Poso Creek Marathon Oil Co. "Midway-Premier" 13 32 27S/27E
10/80: Shoe leak. Well idled indefinitely.

13) Poso Creek Shell Oil Co. "Conoco" 54 33 27S/27E
11/80: Slight migration behind pipe. Well to be used only as emergency stand-by for limited volume and duration injection.

14) Round Mountain Getty Oil Co. Well No. 14 18 28S/29E
12/80: Inj. line leak and tubing hole allowing migration. Well shut-in pending rework and repair.

15) Tejon ARCO Oil & Gas Co. "Tejon A" 58-35 35 11N/19W
8/80: Migration around packer. Well shut-in indefinitely.

1. (b)-1980 Violations

None

1. (c)-Mechanical-Integrity Failures

1.	Casing Failure/collapse	1
2.	Hole in casing	1
3.	Injection line leak	2
4.	Packer leak	10
5.	Shoe leak	2
6.	Hole in tubing	2

2. (a)-Possible causes of degradation of underground drinking water sources resulting from Class II well operations-1940 to present.

1)	West Bellevue	Ancora-Verde Corp.	Well No. 82-32	1970	Hole in casing (Discovered 6/70. Well idled until corrected on 8/7/70)
2)	Kern Bluff	Crestmont Oil & Gas Co.	"Union-Miller" 4	1975	Hole in casing (Discovered 30 days after injection started. Corrected and returned to active status 12/75)

2. (b)-Supplemental list to item 2 (a).

	Field/Area	Operator	Year Discovered	Cause
1.	Canfield Ranch, East Gosford Area	Gulf Oil Corp. "Statex-KCL" 7313	1970	Hole in casing. Well idled.
2.	Greeley	Chevron U.S.A. Inc. "KCL Lease 11" 59	1958	Holes in casing & tubing. Injected only for short perio of time. Well suspen- ded.
3.	Mount Poso, Baker-Grover Area	John L. Sowers Olcese Zone	1979	Produced zone water (fresh) being injected into better quality water.
4.	Mount Poso, Main Area	Thomas Oil Co. Olcese Zone	1975	Produced zone water (fresh) being injected into better quality water.
5.	Mountain View, Arvin Area	Buttes Resources Co. "George" 19	1971	Annular migration. Well idled.
6.	Tejon, Central Area	Gulf Oil Corp. "OMB" 16 C-33 W.I.	1979	Hole in casing. Well idled.
7.	Tejon, Western Area	Gulf Oil Corp. "Tejon Ranch "525-5	1978	Casing failure. Well idled.
8.	Ten Section, Main Area	Shell Oil Co. "KCL-A" 61-30	1968	Annular migration. Well suspended.

2. (c)-Potential degradation situations continuing in excess of one year.

1) Mount Poso-Olcese Zone: Injection into the Olcese zone in this field has been confined to those wells already approved. No further expansion of injection projects is allowed.

3. (a), (b), & (c)-Data on Nonhydrocarbon Producing Zones

1) Alluvium: Broad, thin bed of Holocene sands and gravels. Extends over western one-half of Southern San Joaquin Valley.

2. Tulare: Thick formation of Pleistocene sands extending over entire West ½ of Southern San Joaquin Valley. Grades laterally eastward into Kern River Formation with no significant change in lithology but with noticeable thickening.

3. Kern River: Eastern extension of Tulare Formation described above. Bounded on East by the Sierra Nevada Range.

4. San Joaquin: Relatively thick zone underlying the Tulare Formation. Area extent covers slightly more than the western ½ of Southern San Joaquin Valley. Interfingers with and pinches out into Kern River Formation to east.

5. Echegoin: Massive Pliocene sand covering all but eastern-most portion of Southern San Joaquin Valley. Pinches out at basinal edges.

6. Chanac: Unconformably underlies the Etchegoin and Kern River Formations in the eastern 1/3 of the valley. Truncated to west by fault.

7. Santa Margarita: Directly underlies the Chanac in the eastern 1/3 of the valley. Also truncated by fault.

8. Olcese: Fairly limited zone found only in eastern-most fringe of Kern Co. Truncated on the east by the Kern River Fault and on west by natural pinch-out. Conformably overlain by the Round Mtn. Formation which unconformably underlies the Santa Margarita.

9. Vedder: Thick, Lower Moicene formation covering the eastern ½ of the Valley. Eastern limit interfingers with slightly older Walker zone. Upper limit is an unconformity with the Freeman-Jewett Formation.

10. Tumey: Very thin Oligocene zone found only in the center of the Valley. Truncated on East by a fault. Steeply dipping bed truncated by Tulare Formation angular unconformity approx. ½ mi NW of Blackwells Corner field limits.

11. Walker: Very thin Eocene formation unconformably overlaying basement in "pockets" along the eastern ½ of the valley.

FIELD	ZONE	DEPTH TO TOP OF INJECTION	THICKNESS OF INJECTION INTERVAL	AREAL EXTENT
Bellevue	Etchegoin	3474'	128'-477'	Underlies entire field and extends at least one mile beyond in all directions.
Bellevue, West	Tulare-Etchegoin	2725' (Tulare) 4370' (Etchegoin)	75' (Tulare) 138'-550' (Etchegoin)	Both zones underlie the entire field and extend at least one mile beyond in all directions.
Blackwells Corner	Tumey	1473'	40'	Underlies entire field but is truncated by an angular unconformity approx. 1/2 mile NW of field.
Buena Vista	Tulare	538'	190'-1111'	Underlies entire field and extends at least one mile beyond in all directions.
Cal Canal	Tulare-San Joaquin	1505'	693'	Both zones underlie the entire field and extend at least one mile beyond in all directions but there is a gradual thinning trend in both zones towards the SW.
Canfield Ranch	Etchegoin	3212'	613'-1530'	Underlies entire field and extends at least one mile beyond in all directions.
Coles Levee, North	Tulare	1470'	434'	Underlies entire field and extends at least one mile beyond in all directions.
Coles Levee, North	San Joaquin-Etchegoin	2688'	187'-743'	Underlies entire field and extend at least one mile beyond in all directions.
Coles Levee, South	Tulare-San Joaquin	2189'	1171'	Both zones underlie the entire field and extend at least one mile beyond in all directions.
Greeley	Etchegoin	2802'	260'-2277'	Underlies entire field and extends at least one mile beyond in all directions.
Kern Bluff	Kern River	200'	150'	Underlies entire field and extends at least one mile beyond in all directions.
Kern Bluff	Vedder	4607'	166'	Underlies entire field and extends at least one mile beyond in all directions.
Kern Front	Santa Margarita	2548'	650'	Underlies entire field except the very northern-most limit which is approx. 3 miles from the nearest injector
Kern River	Chanac	1100'	568'	Underlies entire field and extends at least one mile beyond in all directions.
Kern River	Santa Margarita	1698'±	325'-515'	Underlies entire field and extends at least one mile beyond in all directions.

FIELD	ZONE	DEPTH TO TOP OF INJECTION	THICKNESS OF INJECTION INTERVAL	AREAL EXTENT
Kern River	Vedder	4850'	136'-375'	Underlies entire field and extends at least one mile beyond in all directions.
Lakeside	San Joaquin	3360'	30'	Underlies entire field and extends at least one mile beyond in all directions.
Los Lobos	Tulare (proposed)	1950'±	1550'±	Underlies entire field and extends at least one mile beyond in all directions.
Midway-Sunset	Alluvium	399'	125'-252'	Covers entire field and extends at least one mile beyond in all directions.
Mount Poso	Olcese	233'	94'-350'	Underlies entire field and extends at least one mile beyond but is fault-bounded approx. 4 miles to the east of field limits and pinches out to the west at a distance of 2-3 miles.
Mount Poso	Walker	1939' (top of Vedder*)	656'-661'	*Underlies only the NE one-half of the field but is injected into only in combination with the laterally interfingered Vedder Fm. which covers the entire field limits.
Mountain View	Kern River	2680'	1320'±	Underlies entire field and extends at least one mile beyond in all directions.
Pleito	Kern River-Chanac	2372' (Kern River) 2756' (Chanac)	384' (Kern River) 634' (Chanac)	Both zones underlie the entire field and extend at least one mile beyond in all directions.
Poso Creek	Vedder	3640'	95'	Not penetrated is the SW portion of the field but believed to still be present (at depth) over the entire field.
Rio Viejo	San Joaquin (proposed)	5400'	225'	Underlies entire field and extends at least one mile beyond in all directions.
Rosedale	Etchegoin	3767'	181'	Underlies entire field and extends at least one mile beyond in all directions.
Round Mountain	Walker	2300'	270'-702'	Underlies entire field and extends at least one mile beyond in all directions.
Round Mountain	Olcese	450'	290'-1005'	Underlies entire field and extends at least one mile beyond but is fault-bounded on the east approx. 1½ miles from field and pinches out to the west at a distance of about 5 miles.
Seventh Standard	Etchegoin	3580'	1101'-1353'	Underlies entire field and extends at least one mile beyond in all directions.
Strand	Etchegoin	3015'	70'-355'	Underlies entire field and extends at least one mile beyond in all directions.

FIELD	ZONE	DEPTH TO TOP OF INJECTION	THICKNESS OF INJECTION INTERVAL	AREAL EXTENT
Strand	San Joaquin	3090'	732'	Underlies entire field and extends at least one mile beyond in all directions.
Ten Section	San Joaquin	2298'	397'-1027'	Underlies entire field and extends at least one mile beyond in all directions.